Lesson Plan: Understanding Particle Physics with the Lascells Cloud Chamber

Key Stage: 4
Subject: Physics
Topic: Particle Physics & Subatomic Particles
Lesson Duration: 60 minutes

Learning Objectives:

- Understand the concept of subatomic particles and their behaviour.
- Explore the use of cloud chambers in detecting ionising radiation.
- Observe and identify particle tracks produced in the cloud chamber.

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1. Introduction (10 minutes)

- **Starter Activity:** Ask students: "What do you know about atoms and particles? Can you name some fundamental particles?"
- Briefly introduce the concept of particles (protons, neutrons, electrons – covered in KS3 Chemistry) and subatomic physics.
- Introduce the cloud chamber: a device used to detect the presence and behaviour of particles (e.g., alpha, beta, cosmic rays).
- **Key Term:** Ionising Radiation – particles that carry enough energy to turn atoms into ions, by knocking off their electrons.

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2. Demonstration: Lascells Cloud Chamber (25 minutes)

- **Setting up the Cloud Chamber:**
    - Briefly explain how the Lascells Cloud Chamber works: when ionising radiation passes through the chamber, it leaves a trail of ions that causes the supersaturated vapor inside the chamber to condense, forming visible tracks.
    - Emphasise safety and care when operating the cloud chamber.
- **Demonstration:**
    - Set up the Lascells Cloud Chamber prior to the lesson starting as it will need to become cold, in order to visualise the subatomic particles. At the

beginning of the demonstration, explain the set up to students and what they should be looking for.

    - Allow students to observe the tracks produced by different particles (alpha particles, beta particles).
    - Explain the differences in the tracks (e.g., straight tracks for alpha particles, spiral tracks for beta particles).

- **Student Interaction:**
    - Let students take turns observing the cloud chamber and identifing the tracks.
    - Encourage them to hypothesize what type of particles they are seeing and how they can distinguish between them based on the track characteristics.

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3. Discussion and Explanation (10 minutes)

- Discuss the following with the students:
    - What kind of particles create visible trails in the cloud chamber?
    - What can the tracks tell us about the speed and charge of the particles?
    - Discuss how the behaviour of particles in the chamber helps scientists study subatomic physics.
- Relate cloud chamber demonstrations to real-world applications, such as radiation detection and cosmic ray research.

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4. Activity (10 minutes)

- **Group Work:**
    - Divide students into small groups and ask them to research and produce a mind map of real-life situations where understanding particle behaviour might be important (e.g. medical imaging, particle accelerators, radiation safety).
    - Have each group share one example with the class.

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5. Plenary and Recap (5 minutes)

- Summarise the key points of the lesson:
    - What particles can we detect using the cloud chamber?
    - How do the particle tracks help us learn about subatomic physics?
    - Why is this relevant in scientific research?
- **Exit Ticket:** Have students write down their name and one thing they learned today about the cloud chamber and particle physics. Have them hand these in as they leave the lab.